Smart home control system (SHCS) can be integrated into an existing home appliances to reduce the need for human intervention, increase security and energy efficiency. It is still an open research due to difficulties such as network distance, signal interference, user friendliness, high cost, and high power consumption. This book reviews various topics on smart home technologies, including control system, smart home network, smart home appliance and sensor technologies for smart home. A smart home system using internet of things was proposed using internet of things (IoT) and four types of sensors, including PIR, temperature, ultrasonic, and smoke gas sensor for automatic environmental control and intrusion detection. Hardware, software, and test field design will be discussed. The performance of the prototype of smart home system will be evaluated. First, experiments on various sensors will be conducted. Next, the communication channel using wireless and Ethernet modules will be discussed. Moreover, the overall SHCS will be evaluated in terms of hardware and software performance with additional solar charger to improve power efficiency.

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Smart Home System

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Smart Home System using Internet of Things

Design, Implementation and Sample Codes

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LIST OF ABBREVIATIONS

SHCS	Smart Home Control System
IOT	Internet Of Things
OSGI	Open Service Gateway Initial
PUC	Personal Universal Controller
IDS	Intrusion Detection System
SAANET	Smart Appliance alliance Network
PDA	Personal Digital Assistance
CPU	Central Processing Unit
FL	Fuzzy Logic
USB	Universal Serial Bus
NAT	Network Address Translation
SDR	Software Defined Ratio
CHP	Connected Home Platform
ISM	Industrial Scientific Medical
IP	Internet Protocol
LAN	Local Area Network
IEEE	Institute of Electrical and Electronics Engineers
PAN	Personal Area Networks
SIG	Special Interest Group
GUI	Graphical User Interface
IDE	Integrated Development Environment
PIR	Passive Infrared
OSI	Open System Interconnection
WAN	Wide Area Networks
MAN	Metropolitan Area Networks
SCTP	Stream Control Transmission Protocol
UDP	User Datagram Protocol
TCP	Transmission Control Protocol
REST	Representational State Transfer

CHAPTER 1

INTRODUCTION

Frequently our house that is always comfortable is the one that have a complete set of home appliances. We may think that this might be the most comfortable way, but as we can see, there are many systems has been introduced to enhance the traditional access control. Family security also is one of the critical issue. Fire detection capabilities is the main features for protecting the families Hence, the question to be answered is - who needs to take care of the home at every second and every time? An option would be is to incorporate advance smart home control system to assist the family security by detecting the fire and gas leakage.

Nowadays, more people are becoming aware to make their homes to be environmentally-friendly. The smart home enables user to manage the energy consumed and increase savings by controlling lighting, window coverings, irrigation and monitoring usage. The portability and technologies of smartphone increased the users' interest in controlling their appliances from the smartphones. The automated appliance control enable users to execute tasks before arriving home. Smart home control system provide solution for assistive technologies especially to disabled and elderly using the mobile remote control apps. According to the United States online database (2014), 85% respondents said fire detection was one of the most important features when it comes to protecting themselves and their families. Figure 1.1 presents the smart home function and users' level of enthusiasm for the technology.

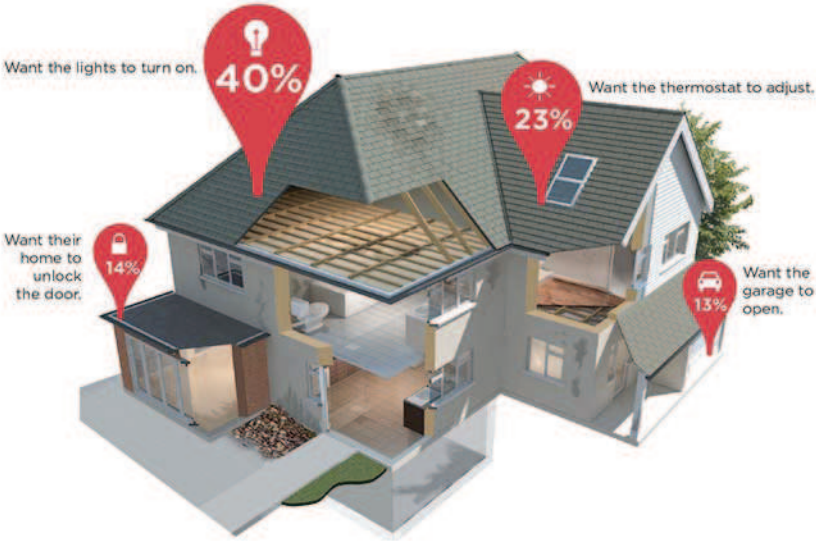

Fig 1.1: Smart Home function (Hagerty et al., 2015)

The terms related to “Home Automation”, “Smart Home” and “Intelligent Home” has been existed in this recent years, which has been used to introduce the idea of networking appliances and devices in house. Home automation system has opened a great research opportunity to the researchers in producing new fields in engineering, architecture and computing.

This book focused more on development of smart home control system because of the increase demand in security and convenience. The fundamental components of SHCS are control system hardware, programming and interface, compatible connected devices to be controlled, and internal network of the smart home.

There are various problems with the conventional smart home. The use of Bluetooth limits the communication to within 100m range only. Furthermore, traditional use of PC as

control system increased the cost and power consumption. Home appliances with remote sensor has higher risk of losing the remote which would end up being unable to control the households. Battery operated remote control requires battery which means that we have to replace the battery at a given time. The infrared based remote control has the weakest limitation which it does not penetrate walls.

Smart home research became popular in the market but this system is not user-friendly to some group of people such as disabled and elderly due to the complexity and cost. GSM practice result in additional charge for every message sent through the network. The system should have human interest GUI interface to permit the user control and monitor. The IOS application needed quite a high profile money, since the developer need to have an iphone and mac first. Website is the best choice to overcome this problem as a single website can reach users across many different types of mobile devices, whereas native apps require a separate version to be developed for each type of device.

This book introduces a smart home control system that would improve the manually household operation. Less personnel is required while increasing the overall safety by integrating the automatic home appliances based on sensor reading and user manual button in website. The automatic function based on the sensor information made the control system to operate effectively and efficiently. The concept of IP networking applications and devices in the house enables the home appliances to be controlled from everywhere from laptop, mobile phone, tablets or smart TVs, provided these devices has access to the internet. The website provide convenience to developers and users, especially for disable and elderly people. This book provides a password protected website to tackle the security issue. Besides, the battery problem is overcome by adding solar recharge controller to recharge the weak battery. This solar recharge controller can also be as a backup resource during blackout.

The aim of this book is to develop a monitoring and controlling system for a household. The specific objectives of the study are to investigate various private home appliances that can be connected to Arduino Ethernet web server, to develop a website to store, process and analyse the user input and sensor data efficiently, and to evaluate its performance and further action such as switching OFF or ON the devices by using the internet.

The book has been accomplished by the following stages subsequently literature review, investigate various home appliances that can be connected to the controller, investigate various sensors for automatic environmental control, design wireless transmission between the Arduino and internet by using Arduino Ethernet shield, to develop website interface to control the home appliances, and to conduct performance evaluation.

This work attempts to investigate and compare the performance of smart home control system with the existing automation system. Home automation carrier mode and website platform is the main field. The design would be able to remotely and automatically switching on and off of any home appliances and control the home environment based on the sensor reading. The design will include microcontroller, interfacing the peripheral devices as input or output, power supply to the system, sensors, smart phone, mechanical parts, software coding and internet communication protocol.